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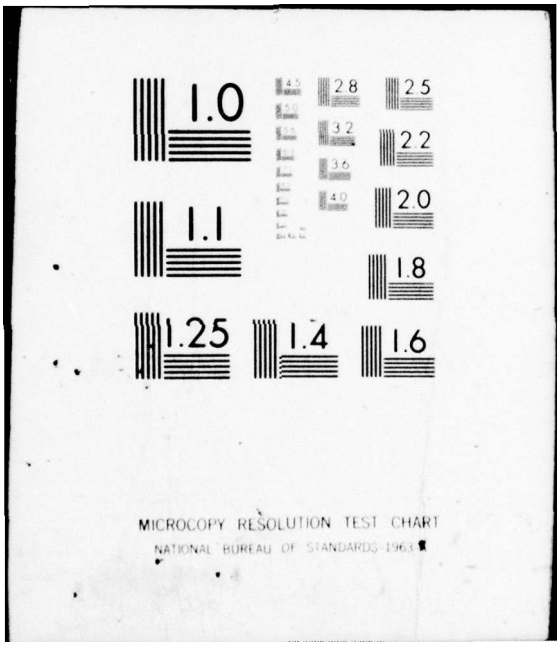
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report discusses the survey of K. I. Sawyer AFB as a potential site for the Seafarer Transmitter Control Center (TCC) and the Transmitter Station (TS). The purpose was (1) to determine potential support for Seafarer by the base, and (2) to determine operational interface and design considerations to enable Seafarer to function smoothly alongside the Air Force.

Results show that K. I. Sawyer AFB appears to be an admirable location for the TCC and TS, and a tentative on-base site has been selected for design guideline purposes.

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GTE SYLVANIA
INCORPORATED
COMMUNICATION SYSTEMS DIVISION

ELF COMMUNICATIONS SEAFARER PROGRAM

SITE SURVEY, FINAL REPORT MICHIGAN REGION

K. I. SAWYER AFB SUPPORT POTENTIAL AND OPERATIONAL INTERFACE

Contract No. N00039-75-C-0309
CDRL SEQUENCE NO. B006
April 1976

Prepared for:

NAVAL ELECTRONIC SYSTEMS COMMAND
Special Communications Project Office
ELF COMMUNICATIONS DIVISION

Prepared by:
GTE Sylvania Incorporated
189 " B " Street
Needham Heights, Mas achusetts 02194

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SECTION 1

INTRODUCTION

1.1 BACKGROUND

This report discusses the survey of K. I. Sawyer AFB as a potential site for the SEAFARER Transmitter Control Center (TCC) and the Transmitter Station (TS). The purpose was (1) to determine potential support for SEAFARER by the base as an input to design and cost trade-offs, and (2) to determine operational interface and design considerations to enable SEAFARER to function smoothly alongside the Air Force at K. I. Sawyer. The survey was conducted by personal interviews, and acquisition and study of 40 Civil Engineering drawings.

A visit was made to K. I. Sawyer by GTE Sylvania engineers during the week of 17 November 1975 for the purpose of conducting interviews with base personnel in a number of areas of mutual interest. Navy representatives who were temporarily in residence at the base made interview arrangements and attended most of the meetings. A number of follow-up phone conversations were held with Sawyer communications, civil engineering, and maintenance personnel to clarify and supplement specific material obtained during the November visits.

About 40 representatives of fifteen organizations at K. I. Sawyer were interviewed. Cooperation was excellent. The organizations and people interviewed are listed in Appendix A. Summary interview records were filed with the Navy. A summary of the follow-up telephone conversations (telecons) is provided in Appendix B. A list of Civil Engineering drawings provided by the base is included in Appendix C. Prints and microfilm aperture cards of those drawings have been distributed to subcontractors and associates. Copies are on file at GTE Sylvania.

The information in this report generally dates from the time of the November meetings. Draft reports were issued in February for Navy review and comment. One of these drafts was forwarded by the Navy in March for Air Force comment, eventually reaching the command at Sawyer. During a 13 April meeting with GTE Sylvania personnel on another facet of SEAFARER, the base commander pointed out minor corrections in the draft report and a few instances where the information has been outdated in the normal course of events since the November interviews. Since the manuscript was then complete, most of the new information has been incorporated by footnote in order to make the report as current as possible without reconducting the interviews.

1.2 SUMMARY OF RESULTS

K. I. Sawyer AFB appears to be an admirable location for the TCC and TS. A tentative site has been selected on-base for design baseline purposes. Sufficient support is available from the Base, either from existing capabilities or by USAF expansion of those capabilities, to enable worthwhile cost trade-offs for system design and development of the Navy/contractor personnel complement. The support will be effected per host/tenant roles in accordance with an Inter-Service Support Agreement.

The operational interface between SEAFARER and USAF at K. I. Sawyer appears practicable.

Results of the survey are being factored into system design studies. Further investigation of operational priorities and interface seems appropriate prior to completion of detail design.

SECTION 2

K. I. SAWYER AFB AND ITS MISSION

K. I. Sawyer is a Strategic Air Command base, located about 20 miles south of Marquette, Michigan. From the base, SAC operates one squadron of B-52H Heavy Bombers and one squadron of KC-135 tankers, plus the operational, maintenance and support crews and equipment for the bombers and tankers. Several USAF tenants also use the base. Those of major interest to SEAFARER are:

a. 87th Fighter Interceptor Squadron

Under the Aerospace Defense Command (ADC), the 87th operates one squadron of F-106 Delta Dart aircraft, plus self-contained maintenance, including electronics, radar, communications, missile and armament shops. The 87th is independent of SAC, but derives most bed-and-board support from it.

b. 2001st Communications Squadron

The 2001st reports through Air Force Communication Service (AFCS) North Comm Area to Griffiss AFB, New York, to AFCS headquarters Richards-Gebaur AFB, Missouri. The Squadron operates and maintains all NavAids, control tower, tower communications, and approach radar for K. I. Sawyer, and provides area supervision for like functions at Marquette Airport.

c. 24th Weather Detachment

Under Air Weather Service, Scott AFB, Illinois, the 24th provides meteorological services for SAC and all tenants, and operates and maintains sensors such as visiometer, rotating beam ceilometer, weather radar, plus communications equipment.

d. Detachment 2, 48th Aerospace Rescue & Recovery Squadron

This detachment provides light helicopter (Huey) rescue for SAC and ADC air crews and, secondly, search and rescue for others.

K. I. Sawyer is also set up as a satellite for a squadron-sized deployment of FB-111's. None were at Sawyer in November 1975 or were expected soon. FB-111 mobile communications vans accompany satellite deployment. SAC personnel interviewed at Sawyer in November 1975 did not predict any support overload or operational conflict between SEAFARER and the FB-111's. FB-111 real estate is not in conflict with SEAFARER.

SAC's 410th Bombardment Wing is the parent organization at K. I. Sawyer. Reporting relationships are depicted in Figure 1. The Wing Commander (Colonel) reports throuth 40th Air Division (Brig. General) Wurtsmith AFB, Michigan to 8th Air Force (Lt. General) Barksdale AFB, Louisiana, thence to SAC Headquarters (General) Offutt AFB, Nebraska. The 410th Wing comprises eight* squadrons:

644th Bombardment - B52H
46th Air Refueling - KC-135
410th Maintenance Control*
410th Avionics Maintenance
410th Field Maintenance
410th Organizational Maintenance
410th Munitions Maintenance
Headquarters Section

The Base is operated and maintained for the wing by the 410th Combat Support Group (CSG). The CSG is fully self-contained and the Group Commander (Colonel), who is alse Base

*Reported now (April 1976) to comprise nine squadrons not including 410th Maintenance Control which is not classified as a squadron.

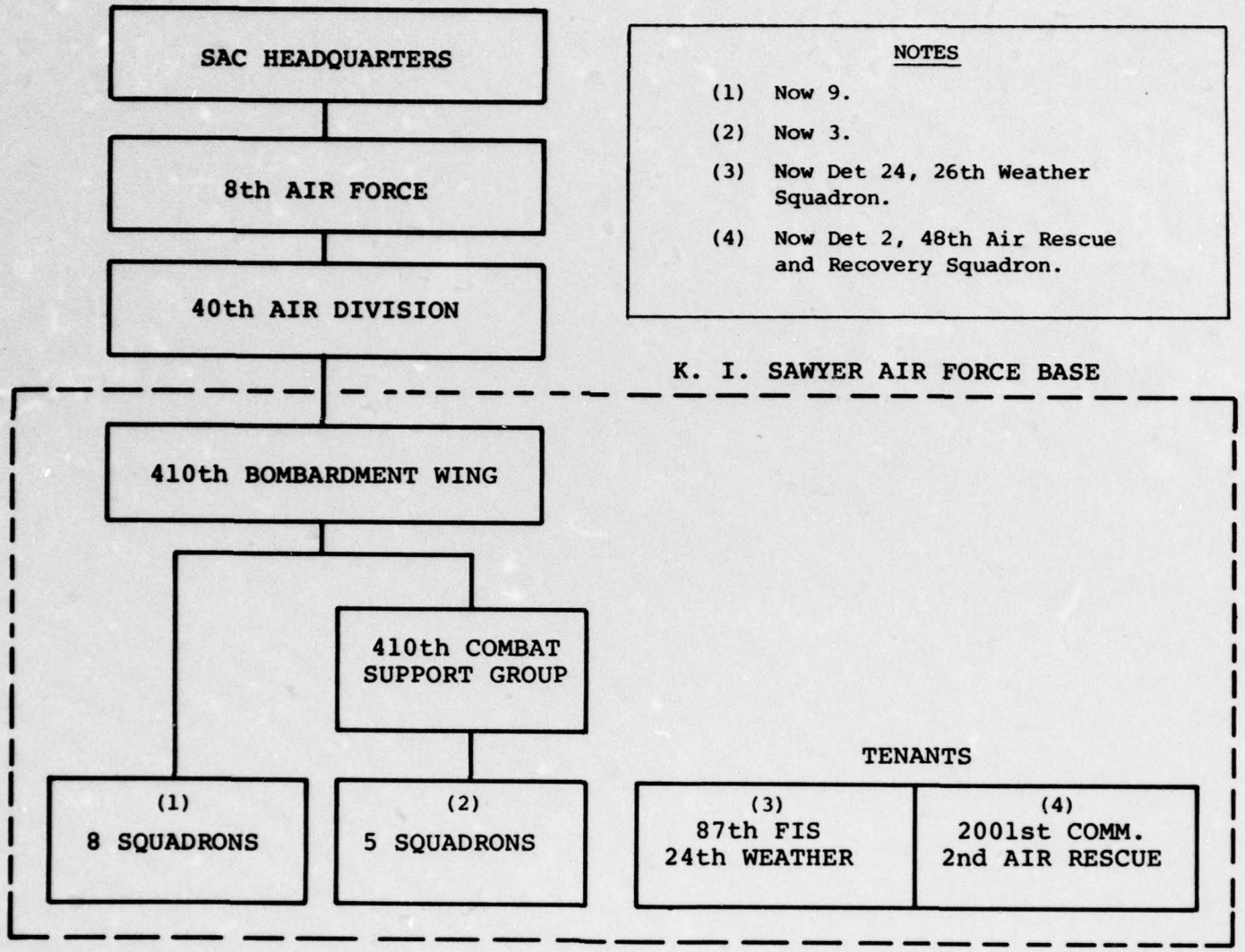

Figure 1. Reporting Relationships

Commander, reports to Wing Commander (Colonel). The Group is composed of five* squadrons:

Civil Engineering
Security Police
Supply
Transportation
Headquarters Section

Support for SEAFARER, and most of SEAFARER/USAF interface, will be with Group. However, most operational interplay will be between SEAFARER and the 410th Wing, 2001st Comm. Squadron, 87th FIS, and 24th Weather, probably in that order

*Now reported to consist of three squadrons; Supply and Transportation have been transfered to 410th Wing.

SECTION 3

SUPPORT FOR SEAFARER FROM K. I. SAWYER AFB

3.1 GENERAL

Support is needed from the Base for a TCC and a TS on base. An Inter-Service Support Agreement, Navy-to-Air Force, would form the basis for a host-tenant relationship.

3.2 SUPPORT CATEGORIES

The following categories of support were investigated:

a. Real Estate and Utilities

b. Civil Engineering, Meteorology, Construction

c. Telephone & Communications

d. Security

e. Supply, Transportation, Maintenance, Contracting Support

f. Billeting, Commissary, Exchange, Disbursing, Medical

3.3 SURVEY RESULTS

3.3.1 Real Estate and Utilities

K. I. Sawyer AFB consists of 5200 acres. SAC and tenant operations, housing, services, recreational facilities, training areas and access ways use about sixty-five percent. Space for SEAFARER is readily available.

A tentative site has been selected for the TCC and TS. The selection process included a review of appropriate civil engineering documents/drawings, personal drive-around and scan, and personal interviews, all in terms of existing SEAFARER criteria and the Air Force missions at K. I. Sawyer. Three excellent possible sites were then evaluated prior to the baseline selection. Figure 2 shows the three sites on a civil engineering drawing (TAB F-1). The selected site,

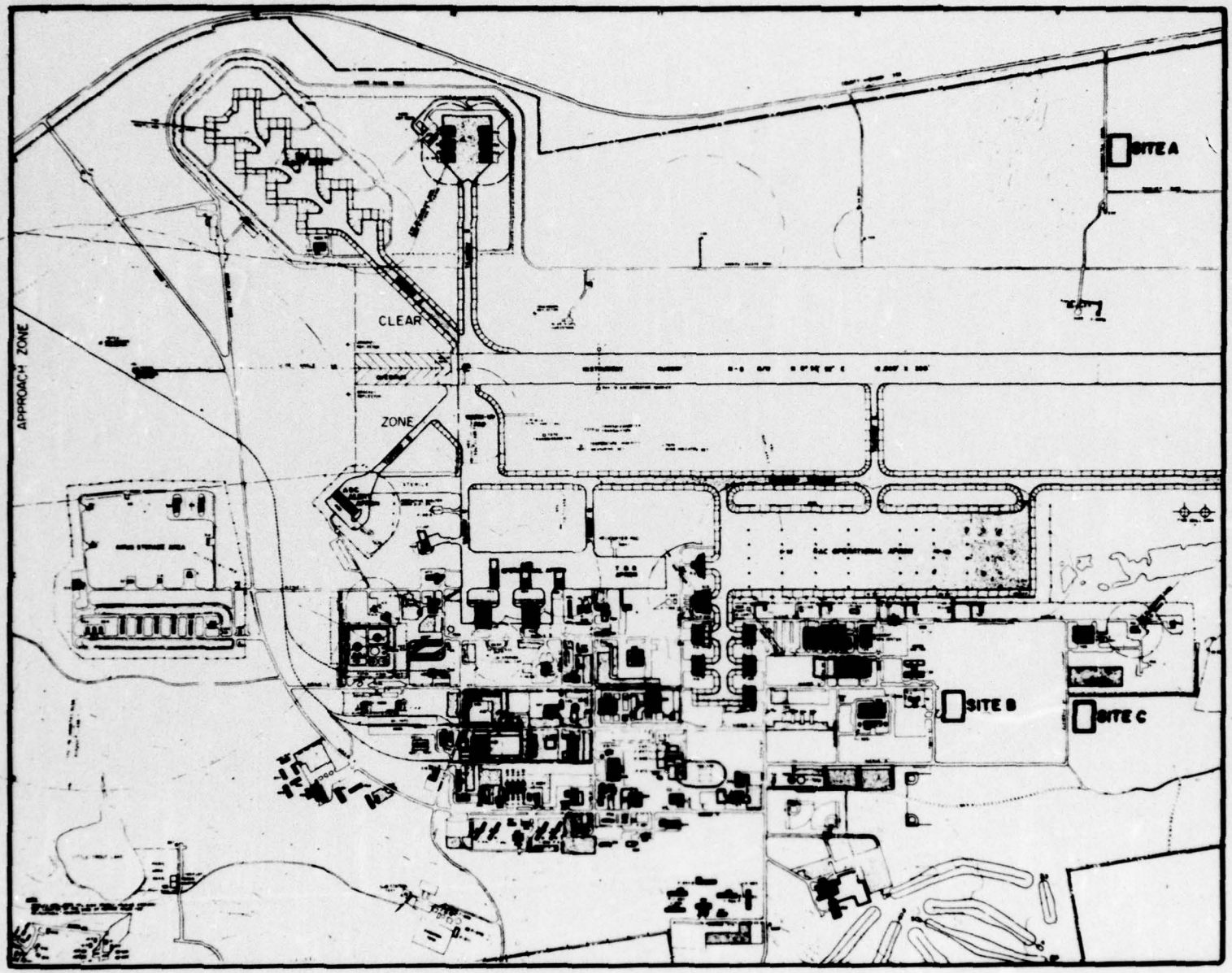

Figure 2. Potential Site Locations - K. I. Sawyer AFB

Site B, offers an area 1250 by 1300 feet (SEAFARER needs only about 250 by 350 feet for the TCC and TS. Access for antenna feed cables can be effected. The site is on the periphery of SAC's operating area, yet close enough to draw support.

Prime power for the Base is furnished by Upper Peninsula Power Company from the Gwinn substation by 69 kV 3-phase 3-wire ACSR line to the Base substation. Upper Peninsula Power Co./Government interface comes after the Base substation metering and grounding panel. Primary base feeders are 7200/12,470 V, 3-phase 4-wire. Base substation transformers have recently been upgraded from 5000 to 7200 kVA. A copy of the October 1975 electric bill for the Base is provided as Appendix D. It may be practicable to provide prime power to SEAFARER from the Base substation by retermination and installation of new feeders. If not, prime power might be brought from Upper Peninsula Power Company lines adjacent to the Base periphery. A run of about two miles on base appears to be involved.

Buried hot water for heat, cold water, and sewage disposal are available at the selected SEAFARER Site B, as well as at potential Site C.

As a matter of interest, most base housing is fed by single-phase unbalanced drops; however, most base operational areas (adjacent to the tentative SEAFARER site) are 3-phase.

3.3.2 Civil Engineering, Meteorology, Construction

Base Civil Engineering maintains drawings of the existing Base and facilities, which serve as the focal point for future planning, growth, and modifications, and will provide excellent support for SEAFARER planning. SEAFARER personnel have been given the 40 drawings that were requested for existing and future facilities. The 40 constitute about 50 percent of all drawings available. The remaining drawings appear to be unneeded by SEAFARER.

Average Base elevation is 1200 feet MSL. The south end of the runway is 1190 feet; the north end, 1220 feet.

National building and fire prevention codes are followed on base. No building height restrictions are listed, but towers are forbidden within approach ways, and tower height in other areas must be pre-coordinated. Restrictions of construction near aircraft aprons, storage of flammables, etc., are listed on Civil Engineering drawings. Heavy construction equipment and construction activities may interfere with NavAids calibration and should be pre-coordinated with 2001st Communications and SAC's Base Communications Officer.

Frost depth runs 5-1/2 to 6 feet under snow cover, 8 feet without snow cover. Water pipes are buried 6 feet under the nearest surface, and sometimes 8 feet under roads because of 2-foot ditches. Communications cables are placed 2-1/2 to 3 feet deep. Mean wet bulb temperature and relative humidity readings, by month, over an eight-year average are found in Table I. A climatological summary, surface-wind value observations, and degree day sheet are provided in Appendix E.

3.3.3 Telephone and Communications

3.3.3.1 Without SEAFARER

a. Telephone

The Base telephone service maintenance and modification is provided by Michigan Bell. Base switchboard and lines are leased. Service is mostly 2-wire for $0.90 per cable per month. The present PBX is a WECO 605 with WECO 701 switching (Strowger type), circa early 50's. The switchboard is scheduled for major modification and improvement during Spring 1977 to Summer 1980. Improvements will include the following:

New console
Compressed dialing
Solid-state switching
Additional 4-wire in-dial service

TABLE I

MEAN TEMPERATURE AND HUMIDITY - K. I. SAWYER AFB

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Mean Wet Bulb Temp	12.0	13.0	21.4	34.0	42.9	52.5	55.6	57.0	50.7	41.4	29.1	18.8	36.7
Relative Humidity	74.1	72.2	71.3	69.9	65.1	69.7	71.1	74.6	79.0	77.3	80.7	79.8	73.7

Present service offers both Class A and Class C. Class C is limited to on-base dialed access. Class A offers out-dial for commercial (9-level) and AUTOVON (8-level). Limited 4-wire in-dialing (direct dial) is provided. This service is to be expanded during the 1977-80 update cycle. Cables are run overhead in some on-base areas and are buried in some areas. An overhead telephone cable runs adjacent to the tentative SEAFARER location.

b. AUTOVON

About 20 AUTOVON accesses are presently used by SAC. Some have priority over-ride. PBX to AUTOVON access is 4-wire. Access for AUTOVON uses special code numbers.

c. AUTODIN

SAC has AUTODIN Mode 1, 1200 - 2400 baud; terminal and modems from Western Union; lines (4-wire) via Michigan Bell from AUTODIN System Control.

d. Special Communications

Special nets and communications features are provided to SAC at K. I. Sawyer. The list includes:

AUTOSEVOCOM (Secure Voice) Wideband
AUTODIN (See above.)
AUTOVON (See above.)
SACCOM 465L
SLFCS 487L
EWO/PAS
SAC Telephone Net (STN)

Special communications are also provided to Aerospace Defense Command.

3.3.3.2 SEAFARER Requirements

SEAFARER telephone and communications needs were discussed with K. I. Sawyer communications people and Michigan Bell

as follows:

a. Telephone - 4 lines, 8 instruments, direct in-dial.

b. AUTOVON - Possible requirement for access. No secure voice required.

c. AUTODIN - Mode 2, TTY, 76 baud.

d. Radio - For communication between TCC and remote maintenance/security teams. Possible future requirement of injection link to TCC from SEAFARER Broadcast Authority.

Standard telephone and AUTOVON arrangements will be made directly with Michigan Bell. AUTODIN terminal requires Navy request to Western Union for terminal and modem (if required). Western Union leases lines from Michigan Bell.

K. I. Sawyer Communications and Civil Engineering express concern about possible antenna towers. Except for flight path restrictions, towers are not forbidden; advance coordination is advisable.

3.3.4 Security

K. I. Sawyer Security provides both fixed-position and roving security coverage on base; backup is furnished by quick-reaction teams. Roving coverage for SEAFARER on-base will be provided - probably without the necessity of additional staff. Fixed-position coverage can be furnished by the addition of one personnel slot per shift. Extension of the quick-reaction team concept for coverage of remote SEAFARER transmitters would be difficult to effect. Eighth Air Force approval would be required. Civil authority approval would also be required for investigation, posse and pursuit. Quick-reaction transport of AF or Navy security forces by Air Rescue helicopter does not appear practical. Air crew rescue and civil emergency air search would have priority. The helicopters fly only for emergencies during inclement weather. Details were not explored.

3.3.5 Supply, Transportation, Maintenance, Contract Support

These areas of support were emphasized because it appears intuitively that significant cost savings can be realized by optimum use of existing USAF capabilities.

a. Supply

Base Supply operates on a computerized record/reorder system. About 40,000 line items are stocked, some in multiple quantity. Through 1971, about 89,000 line items were stocked. Economy dictated reduction. Addition of common SEAFARER items to USAF ordering system is feasible. It appears that the Navy should supply peculiar SEAFARER items separately. USAF will cooperate with Navy Supply and would welcome a Navy supply person working in USAF supply facilities. The problem of ownership and liability for parts would need to be resolved. USAF can furnish plentiful bin storage for SEAFARER. However, bulk storage for large items such as cable reels or equipment needs further resolution. USAF can local purchase items for SEAFARER.

b. Transportation and Maintenance

Base Transportation controls and maintains 437 vehicles, including 30 huge snow blowers. A new large-vehicle overhaul center is under construction. The Squadron has extensive capability for corrosion protection and control. It also maintains ADC vehicles when deployed at Calumet, 100 miles distant. The Squadron can easily handle the extra workload of an estimated 10 SEAFARER vehicles and heavy equipment, can provide remote tow truck service, and has the capability to maintain heavy contractor equipment, although liability and risk might become sticky issues. The Squadron will be "happy" to plow the Navy out from under snow drifts.

Grounds, building, and equipment maintenance support can be provided for SEAFARER. USAF and the civilian - Upper Peninsula (UP) - sector capabilities for maintenance of heavy electrical equipment and sophisticated electronics other than avionics are limited.

Transportation of goods and supplies to and from the UP by common carrier is slow, unpredictable, and frustrating. Two long-haul scheduled truck lines serve the area; however, both wait for full loads, re-route merchandise to acquire full loads, and sometimes off-load small items for later transfer. Rail service is patchy. Air freight is subject to weather and airline decisions (Marquette is often the end of the run). Shipments through Chicago arrive more dependably than shipments through Detroit. Log Air military charter is dependable.

c. Local Contracting and Services

The UP does not operate under union shop or closed shop for construction and services. The Base contracts small jobs to local firms and can help SEAFARER, and the Army Corps of Engineers contracts major tasks (including current modernization/expansion of the hospital). Bidders are limited; typically only two electrical contractors bid. Sault St. Marie firms do not usually bid so far west. The Base contracting staff is qualified and knowledgeable, and can probably assist SEAFARER in dealing with local firms.

3.3.6 Billeting, Commissary, Exchange, Disbursing, Medical

a. Billeting

The Base personnel complement including tenants is:

538 Officers
3340 Enlisted
520 Civilians (Most reside off-base.)

This complement and size are expected to remain stable. Emergency satellite deployment of FB-111's to K. I. Sawyer adds one partial squadron of people (about 150). The last such deployment was in 1973. Future deployments are likely. The Base can house single and married SEAFARER officers and can separately collocate single officers and single enlisted into SEAFARER officers' quarters and SEAFARER enlisted quarters. Housing for married enlisted is in extremely short supply both on and off base. A Base five-year housing plan is being finalized. USAF would welcome a SEAFARER plan for input. About ten transients, officer or enlisted, can usually be accommodated.* There are no official transient-family guest quarters, but multiple VOQ billets are provided transient families. The Base also has mobile homes and plots for personally-owned mobile homes. These capabilities are being expanded.

b. Commissary, Exchange

Full commissary, exchange and clothing store services are provided. These report to tri-service common control rather than to K. I. Sawyer and SAC. The Base does have an overseer function and can arrange SEAFARER support, but Navy clothing and uniform items may have to be acquired from Navy installations.

c. Disbursing

USAF disbursing is by Joint Uniform Military Payroll System. Accounting and finance are headquartered in

*No housing for SEAFARER personnel is now available. Since November, the influx of Air Force officers and enlisted men has taken up all available Base housing. No relief from this situation is forecast.

Denver. The Base Comptroller offers to handle TDY and special vouchers, but suggests that SEAFARER maintain its own local records and draw from the Comptroller's staff for support. USAF could handle SEAFARER pay records, but it seems complicated.

d. Medical

Full medical/hospital services are available for Navy and dependents. Emergency first-aid will be provided for SEAFARER contractors working on-base.

The Base and nearby UP communities cannot fully accommodate the CHAP (Children Have A Potential) program for children who are emotionally disturbed or physically or mentally handicapped, but available support will gladly be extended to Navy families.

SECTION 4

OPERATIONAL INTERFACE

4.1 GENERAL

Obviously, there are both policy matters and design considerations relative to the operation of two separate strategic missions - heavy bombers and submarine communications - through one node, in this case, K. I. Sawyer. This section focuses on the design or system considerations. Much information needed for design input is also useful for interference mitigation and is included here as an aid to both efforts.

4.2 SEAFARER AND THE 410th BOMBARDMENT WING

The 410th Wing operates a Wing Command Post (WCP) in Bldg. 726. The 644th (bombers) and 46th (tankers) operate subordinate to the WCP. Emergency directives come from the 40th Air Division (and higher) to the WCP. The WCP controls aircraft and crews. For normal training and proficiency, operation of the aircraft and crew planning and deployment originates with the 644th and 46th squadrons. Crews fly proficiency missions of about five hours with takeoff at mid-morning and landing at 1400 - 1800 hours. Each mission involves two or three instrument approaches with great use of NavAids/landing aids, plus three or four visual approaches.

A preliminary overview of known B-52H and KC-135 electronic/avionics does not turn up any likelihood of major electronic interference to SEAFARER. The survey in this area was not exhaustive. The potential for accidental interruption of SEAFARER's mission or for priority conflict in real time with SEAFARER appears worthy of further investigation and coordination. Cooperation and support at K. I. Sawyer are excellent. However, communications priorities, content and complement of the WCP, and the emergency priority doctrines

need further study. Such investigation is considered beyond the need of this initial study.

One area possibly sensitive to electromagnetic interference is wind integration, magnetic variation for the ASB-9 Bomb/Nav system, and the associated heading/flux gate inputs to the auto pilot and to panel displays from wing-mounted flux valves. A check of these inputs/computations is performed near the south end of the runway (sometimes called Compass Rose). The SEAFARER TS will be located more than 6,000 feet from the Compass Rose. Since compass swing calibrations are very sensitive, however, the possibility of electromagnetic interference from SEAFARER is of concern. The Air Force has verbally noted that such a possiblity of interference exists.

4.3 2001st COMMUNICATIONS SQUADRON

The 2001st installs, operates, calibrates, and maintains NavAids, landing aids, and tower communications. These items are installed and operate along a perimeter on each side of the main runway and in a fan-shaped spread over the approach areas at each end. Landing aids are very critical for all flight operations; the RF field calibration is sensitive; a fine line exists between maximum usable sensitivity and excess alarms. The 2001st experience indicates that heavy-equipment near the fans causes localizer alarms. SEAFARER on-base heavy construction may need pre-coordination. Preliminary discussions indicate the aids can probably be recalibrated to accommodate steady-state SEAFARER TS operations. TCC functions should not cause interference. Further investigation appears warranted.

A visiting Colonel from AFCS North Comm. Area, Griffiss AFB, was present for the interviews, showed great interest, and suggested that SEAFARER specifications and plans might profitably be chopped through AFCS North Comm. Headquarters and the 2001st at Sawyer for information and comment.

The 2001st technicians caution SEAFARER that the Base has an electrical grounding problem.

4.4 87th FIGHTER INTERCEPTOR SQUADRON

F-106's of the 87th fly emergency alerts as directed through the ADC hierarchy plus normal flight operations consisting of training and proficiency missions. Typical proficiency flights are as follows:

Takeoff	-	1100 or 1600 Hrs.	
Profile	-	Training mission	1-1/2 Hrs.
		Intercept	2 Hrs.
		Refueling	3 Hrs.
Landing	-	2 instrument approaches 4 VOR approaches	} per landing

The 87th provides its own electronics/avionics maintenance. F-106 avionics and missile electronics were not studied.

As a tenant, the 87th suggests that priorities be pre-coordinated with the host, since SAC gears up in a hurry when an EWO comes down. Potential coordination includes:

- Common telephone switchboard
- Potential restriction of SEAFARER maintenance
- Communications
- Freedom of personnel movement
  - On base
  - To and from base
- Transportation/maintenance
- Food service

4.5 24th WEATHER DETACHMENT

The 24th operates several meterological sensors on base. Potential interference to or from SEAFARER is not obvious.

SECTION 5

APPENDIXES

Appendix A: Organizations and People Interviewed

Appendix B: Telecon Follow-Up

Appendix C: Index to Civil Engineering Drawings and Narrative

Appendix D: Electric Bill, October 1975

Appendix E: Climatological Data

APPENDIX A

ORGANIZATIONS AND PEOPLE INTERVIEWED

ORGANIZATIONS & PEOPLE INTERVIEWED

KI Sawyer AFB

11/18/75-11/20/75

Lt. Col. E. J. Braman Marty Marin	Cdr 410th Civil Engrg. Sqdn. Deputy Civil Engr	0730	11/18
Lt. Col. E. S. Eastman	Resource Mgmt.	0800	11/18
Col. G. F. Heinrich Lt. Col. F. A. Fredeen	Cdr. Opns/Deputy Wing Cdr Deputy	0830	11/18
Lt. Col. Clarke	Cdr. 644th Bomb Sqdn	0900	11/18
Col. W. D. (Bill) Norris Lt. Col. John Yount	Base Cdr/410th Spt Grp Cdr Deputy	0930	11/18
Capt. Wallace TSgt Cohn	Security Police Security Specialist	1000	11/18
Maj. R. J. Thompson	Comptroller	1030	11/18
Capt. Rucoba	Procurement Chief	1100	11/18
Mrs. Mitchell	Construction & Non-Personal Services		
Mrs. Ruska	Supplies		
Sgt. Box	Maintenance Contracts		
Lt. Col. Fisher	Commissary & Billeting	1130	11/18
Lt. Col. Knapp	Transportation	1330	11/18
Marty Marin Ron Pelto	Deputy Civil Engr Chief Engr	1500	11/18
Lt. Col. Richard E. Ring	Cdr, 46th Air Ref Sqdn	0900	11/19
Maj. Jerry Copeland	Cdr. 24th Weather Det	0945	11/19
Lt. Col. Sturk	Chief of Supply	1100	11/19
Maj. Parret Lt. Baldwin TSgt Henderson	2001st Comm Squadron 2001st Maint. Chief	1300	11/19
Col. Bunch	Staff to Brig. Gen. Yost of AFCS North Comm	1300	11/19
Capt. Cater	Hospital Registrar	1400	11/19
Lt.Col. Woody Bays Maj. Jack Slattery	87th FIS	1445	11/19

Maj. D. Santacroce	Wing Communications	0830	11/20
Lt. Col. Locke	Maint. Control	0915	11/20
Lt. Conkle	Maint. Chief		
CM Sgt Landowski			
SM Sgt Purcell			
MSgt Exley			
MSgt Mosher			
MSgt Barnhardt			
TSgt Nelson			
TSgt Canbonski			
TSgt Matthews			

APPENDIX B

TELECON FOLLOW-UP

TELECON FOLLOW-UP AT K. I. SAWYER

1. GTE Sylvania to Ron Pelto, Base Chief Engineer 12/9, 11, 12/76 (three calls) - SEAFARER site selection, avoidance areas, utilities.

2. GTE Sylvania to Major Dante Santecroce, Base Communications Officer 12/11/75 (two calls) - telephone & communications.

3. Michigan Bell to GTE Sylvania 12/17/75 - telephone & special communications, existing and possible.

4. GTE Sylvania to Ron Pelto, Base Chief Engineer 1/14/76 - prime power discussion.

5. GTE Sylvania to Ron Pelto, Base Chief Engineer 3/24/76 - base power substation.

ELF OPERATIONS

D/ SSTR- 0420

TELECON REPORT

DATE: 12/9, 11, 12/75

CALL TO: Ron Pelto ORG: K. I. Sawyer, Chief Engineer

CALL FROM: Tom Crabtree ORG: GTE Sylvania

SUBJECT: On Base Site, Avoidance Areas, Utilities PV___ WTF O&M___

DV___ OTHER___

DISTRIBUTION:

x	SPO FILE (2)	___	G.L. DOWNS	___	
___	J.M. BARRON	___	E.W. JERVIS	___	
x	D.A. BOOTS	___	C.J. MASISON	___	
x	G.V. BRADSHAW	___	E.J. MCELROY	___	
___	M.J. BRADY	___	R.D. WARSHAWER	___	

REPORT ISSUED BY: T. M. Crabtree DATE: 12/12/75

NARRATIVE: Three calls - Examining and discussing characteristics of potential on-base sites. Sylvania had looked at several areas in November while on-base and via telecons asked the Chief Engineer for further data regarding characteristics, exclusions, avoidances, prohibitions, pros & cons of six possible sites.

The six sites using Base Civil Engineering Drawing Lab F1 Base Plan are located as follows:

See Attachment A

ACTION REQUIRED/SUGGESTED:

Attachment A

SITE DESIGNATION	COORDINATES	COMMENTS
A.	A-9	Excellent location out of SAC's may, west of runway, remote from Compass Base, excellent out cable access, NW of built up area. No sewerage, head, water. Long run for electric power, might have to sink a ground sheath. Difficult access to Base support areas.
B.	C-D-9	Excellent site, flat firm terrain all utilities available on site. Access to grounding counter-poise. Remote from Compass Rose. Envy access to Base support. Excellent antenna cable access.
C.	D-9	Excellent site. Same features as site B would require removal of some jack pines, may be a little close to general Base recreation.
D.	D-13	Space cramped, bit too close to officer's club. Excellent utilities and access to prime power.
E.	D-14	Too much people traffic. Too close to Front Pond, rough terrain. Too close to munitions, might run into future expansion restrictions. Excellent prime power access.
F.	G-9	Rough terrain, too close to area considered living quarters. Excellent utilities, prime power. Easy antenna cable access but might require private party easement.

will recommend final consideration of site B, A, C with B the lead choice.

ELF OPERATIONS

D/SSTR- 0317

TELECON REPORT

DATE: 12/11/75

CALL TO: MAJOR Dante Santecroce ORG: 410th Bomb Wing-Communications

CALL FROM: K. Kilburn ORG: CSD - System Engineering

SUBJECT: K. I. Sawyer Telephone Service PV___ WTF O&M___

DV_x_ OTHER___

DISTRIBUTION:					
_X_	SPO FILE (2)	___	G.L. DOWNS	X	J. Rossbach
_X_	J.M. BARRON	___	E.W. JERVIS	X	R. Sullivan
_X_	D.A. BOOTS	_x_	C.J. MASISON	X	X. DeAngelis
_X_	G.V. BRADSHAW	___	E.J. MCELROY	X	K. Kilburn
___	M.J. BRADY	___	R.D. WARSHAWER	X	T. Crabtree

REPORT ISSUED BY: K. Kilburn DATE:___

NARRATIVE:

Initial contact call to LCDR G. Luzum at K. I. Sawyer AFB to officially ask if direct conversation with MAJOR Santecroce is advisable. G. Luzum said this was no problem and informed me of his code and extension. - (0900 AM), The initial call to MAJOR Santecroce found him not available; however, a SGT Eatton (AF), an outside cable installer, was available for questions. The following are highlights -

- TELCON service 2-wire 20Hx 90-105volt ringdown circuits - lease rate 90¢ per cable pair per month - 4-wire service available for an extra $1.85 per month.
- K. I. Sawyer uses a MANVAL in-dial PBX (STROWGER) circa early 50's) with a Class A or C service. Class A is Autovon access 2-wire with 8/9 level outdial capability. Access for toll or Autovon (8 level) is by special code numbers. Class C service is intrabase.
- There would be no problem with special 4-wire
- Many abandoned cables are available around the base including an abandoned COAX (possible candidate for IFCS test bed).

ACTION REQUIRED/SUGGESTED:

- PBX to Autovon access is 2-wire.
- Other special accesses for SAC have been installed, but SGT Eatton did not know what they were.

-10.15 AM

Recalled MAJOR Dante Santecroce. The following are highlights of the conversation.

- The present frame/board is a WECO 708 1000 line switchboard with 90% utilization.
- The 708 interfaces Autovon with 19 two wire accesses (some priority).
- The 708 is due to be replaced by a modern solidstate board (no nomenclature) with date of completion 30 March 1977. Completion of a fully consoled and compresses board by 1985.
- The MAJOR also stated that SAC has a DSTE Autodin terminal (Mode 1 - hi speed).
- MAJOR Santecroce is expected to return to me on 15 December to inform me whether Autodin is military or western. Union installed. This would require some thought since WV modem and maintenance would be inside shielded TCC room and be more expensive with more outages.
- The MAJOR finally replied that much outage occurs due to the "antiquity" of the WECO 708 and storms. This should be a possible consideration of going to more lines as back up.

ELF OPERATIONS

D/ SSTR-0325

TELECON REPORT

DATE: 12/17/75 at 4:00

CALL TO: K. Kilburn ORG: CSD System Engineering

CALL FROM: Richard Vivian ORG: Michigan Bell Rep at K. I. Sawyer

SUBJECT: Michigan Bell Services at K. I. Sawyer PV___ WTF O&M___

DV x OTHER___

DISTRIBUTION:					
x	SPO FILE (2)	___	G.L. DOWNS	x	J. Rossbach
x	J.M. BARRON	___	E.W. JERVIS	x	X. DeAngelis
x	D.A. BOOTS	___	C.J. MASISON	x	A. Murphey
x	G.V. BRADSHAW	___	E.J. MCELROY	x	T. Crabtree
___	M.J. BRADY	___	R.D. WARSHAWER	x	R. Sullivan

REPORT ISSUED BY: K. Kilburn DATE: 12/18/75

NARRATIVE: Mr. R. Vivian of Michigan Bell contacted me in response to a question asked of Major Dante Santerocz (SSTR-D/0317) in regards to AUTODIN service. Mr. Vivian answered more detailed questions as follows

1. What outside cable services are available? Either overhead or buried depending on base location.

2. What specifically is the lightning protection? Carbon block (Mr. Vivian did not know breakover voltage but will find out).

3. What are characteristics of 2-wire normal telco lines? Common battery requires 48 VDC; 20 Hz 90 volt ringdown, no touch tone available. Michigan Bell will provide and has provided special services or stunt boxes for unique applications (EMI/TEMPEST was one such application) for a monthly charge ($18 per line/month). In general, for SAC Comm Center where AF provided "box" detail and Michigan Bell built box. Military must provide facilities (e.g. conduit).

4. AUTOVON has all 4-wire access. No 2 wire. Both normal and SAGE AUTOVON.

5. Base PBX is a 605 with a WECO 701 switching system.

6. How can AUTODIN be provided? Navy must go to Western Union on contract to request an AUTODIN terminal. Western Union then leases the wire from Michigan Bell to match their terminal.

ELF OPERATIONS

D/SSTR- 0422

TELECON REPORT

DATE: 1/14/76

CALL TO: Ron Pelto ORG: K. I. Sawyer AFB, Chief Engineer

CALL FROM: Tom Crabtree ORG: GTE Sylvania

SUBJECT: Prime Power Availability PV___ WTF O&M___

DV X OTHER___

DISTRIBUTION:

___	SPO FILE (2)	___	G.L. DOWNS	___	
___	J.M. BARRON	___	E.W. JERVIS	___	
___	D.A. BOOTS	___	C.J. MASISON	___	
X	G.V. BRADSHAW	___	E.J. MCELROY	___	
___	M.J. BRADY	___	R.D. WARSHAWER	___	

REPORT ISSUED BY: Tom Crabtree DATE: 1/14/76

NARRATIVE:

Recheck of data acquired personally in November and by telecon in December. Also asked for and received details as follows:

Main power line from UP Power Co. Gwinn Substation is 69KV, 3Ø 4 wire ACSR to Base Substation. Government interface comes after substation metering/ grounding panel. Primary base feeders are 7200/ 12,470V, 3Ø, 4 wire. Base substation transformers are 5,000 KVA capable of 7,200 KVA with blowing and they belong to Power Co. Provision of prime power to SEAFARER from Base Substation would require metering, switching, regulation and might require peak load agreements with Power Co.

ACTION REQUIRED/SUGGESTED:

System designers keep in touch with Base Civil Engineer and Power Company.

ELF OPERATIONS

D/SSTR- 0421

TELECON REPORT

DATE: 3/24/76

CALL TO: Ron Pelto ORG: K. I. Sawyer AFB, Chief Engineer

CALL FROM: Crabtree/Fossum ORG: GTE Sylvania

SUBJECT: Power Substation Configuration PV___ WTF O&M___

DV X OTHER___

DISTRIBUTION:

___	SPO FILE (2)	___	G.L. DOWNS	___	
___	J.M. BARRON	___	E.W. JERVIS	___	
X	D.A. BOOTS	___	C.J. MASISON	___	
X	G.V. BRADSHAW	___	E.J. MCELROY	___	
___	M.J. BRADY	___	R.D. WARSHAWER	___	

REPORT ISSUED BY: Tom Crabtree DATE: 3/24/76

NARRATIVE:

2 telecons - GTE Sylvania asked for details of Base Power Substation interconnections, switching, interfaces and regulation and about running a power line to the SEAFARER on-base site. The Base Engineer provided all information requested. Details are being incorporated into SEAFARER design. It appears technically feasible to provide prime power to the SEAFARER on-base site from the Base substation. Some modifications are known to be required, management permission to draw power from the Substation was neither requested nor received.

ACTION REQUIRED/SUGGESTED:

APPENDIX C

INDEX TO CIVIL ENGINEERING DRAWINGS AND NARRATIVE

DRAWINGS AND NARRATIVE

TAB A

1 of 8	Master Plan Report (Narrative)
2 of 8	" " " "
3 of 8	" " " "
4 of 8	" " " "
5 of 8	" " " "
6 of 8	" " " "
7 of 8	" " " "
8 of 8	" " " "

TAB C4

1 of 1	Real Estate Map

TAB C6

1 of 1	Soil Boring Plan and Location of U.S.C.G.S. Monuments

TAB D

1 of 1	Meteorological Data

TAB E-1

1 of 1	Approach Zone Obstructions

TAB E-2

1 of 1	Approach Zone Obstructions - Details

TAB E-3

1 of 2	Air Space Obstructions - Vicinity
2 of 2	Air Space Obstructions - Vicinity

TAB F-1

1 of 3	Base Plan
2 of 3	Development Plan (Basic Mission)
3 of 3	Development Plan (Basic Mission)

TAB F-1.1

1 of 1	Proposed Aircraft Parking Plan

TAB F-3

1 of 1	Vicinity Noise Contour Map

TAB F-4

1 of 1	Base Noise Contour Map

TAB G-1

1 of 2	Water Supply System
2 of 2	Water Supply System

TAB G-2

1 of 2	Sanitary Sewer System
2 of 2	Sanitary Sewer System

TAB G-3

1 of 3	Storm Drainage System
2 of 3	Storm Drainage System
3 of 3	Storm Drainage System

TAB G-4

1 of 4	Electrical Distribution System
2 of 4	Electrical Distribution System
3 of 4	Street Lighting System (Base)
4 of 4	Street Lighting System (Housing)

TAB G-5

1 of 1	Central Heating

TAB G-6

1 of 1	Airfield Lighting

TAB G-6.1

1 of 2	Base Area Communication and NavAids System
2 of 2	Housing Area Communications System

TAB G-6.1A

1 of 3	Telephone Communication System
2 of 3	Telephone Communication System

TAB G-7

1 of 1	Liquid Fuel System

TAB G-8

1 of 1	Cathodic Protection System

86-04-29 Sheet 44 - Primary Runway Duct Layout
Sheet 45 - Primary Taxiway, T/W "C" Warmup Pad and Alert Taxiway and Apron Duct Layout
Sheet 46 - Primary T/W; T/W "B" "C" "D" "E" "F" "G"

APPENDIX D

ELECTRIC BILL, OCTOBER 1975

R. N. 30/650 Houghton, Michigan, October 24, 1975

Base Civil Engineer
K. I. Sawyer Air Force Base
Gwinn, MI

TO UPPER PENINSULA POWER COMPANY DR.

Form L-1630

WP & C-1 (New Rate)

K. I. Sawyer Air Force Base
Contract No. F20613-70-C-0086

Readings:

Meter No.	2600	Meter No.	8140
10/22/75	4477		2135
9/22/75	9722		2041
	4755		94
Constant	1000		10
	4,755,000 KWH		940 KW
	18,000 KWH Used by School		
	4,737,000 KWH		

Maximum Demand: 8,856 KW - 168.8 KW = 8,687.2 KW

Demand Charge:		
200 KW @ $6.00		1,200 00
2,800 KW @ $5.10		14,280 00
5,687.2 KW @ $4.75		27,014 20
Energy Charge:		
500,000 KWH @ 1.50¢		7,500 00
4,237,000 KWH @ 1.40¢		59,318 00
Fuel Clause Adjustment:		
4,737,000 KWH @ .917¢		43,438 29
		152,750 49
Outer Marker:		
940 KWH @ Rate C-1		57 64
Fuel Clause Adjustment:		
940 KWH @ .917¢		8 62
		66 26
Net Bill for October, 1975		152,816 75

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED.
UPPER PENINSULA POWER COMPANY
BY _____ ASSISTANT TREASURER

Due: November 7, 1975

..P.S.C. No. 5
UPPER PENINSULA POWER COMPANY — Fourth Revised Sheet No. 15.0
Houghton, Michigan — Cancels Third Revised Sheet No. 15.0

RATE "P-1" LARGE LIGHT AND POWER

WHO MAY TAKE SERVICE:
Any customer for light and power purposes when the metered demand is 200 kilowatts or more.

TERRITORY APPLICABLE:
All territory served in the Company's interconnected system.

CHARACTER OF SERVICE:
Three-phase, alternating current, 60 hertz, at standard available voltages.

RATE:
Capacity charge per kw of billing demand per month.

First	200 kw or less	$1,200.00
Next	2,800 kw	5.1¢ per kw
Over	3,000 kw	4.75¢ per kw

Energy charge per kwh per month.

First	500,000 kwh	1.50¢ per kwh
Next	5,500,000 kwh	1.40¢ per kwh
Over	6,000,000 kwh	1.35¢ per kwh

MINIMUM CHARGE:
The capacity charge included in the rate plus energy but not less than $1,200.00.

TERMS OF PAYMENT:
Customers will be billed at gross rates which are 3% in excess of the above charges. The net amount is applicable for payment within 21 days from the date of bill.

DETERMINATION OF BILLING DEMAND:
Billing demand shall be the maximum 15 minute demand during the month but not less than 200 kw.

ADJUSTMENT OF OFF-PEAK HOURS:
Demands created during off-peak hours may, at the option of qualifying customers, be adjusted as provided in Off-Peak Service Rule 18.

CONTRACT:
One year or more.

Issued: Effective: For service rendered on and after

Issued under the authority of Order of Michigan Public Service Commission, dated _____ in Case No. _____

RATE "WP-1" - [illegible] POWER

FUEL CLAUSE: (Continued)
This rate is subject to the Company's Standard interconnected system fuel adjustment.

APPLYING:
Service is governed by the Company's Standard Rules and Regulations.

APPENDIX E

CLIMATOLOGICAL DATA

CLIMATOLOGICAL SUMMARY
K 1 SAWYER AFB, MICHIGAN

TEMPERATURE (F)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Extreme Maximum	45	47	63	83	94	102	99	95	87	80	66	47	102
Mean Maximum	19.9	22.7	32.3	46.9	59.4	69.8	74.9	72.9	63.7	53.7	36.8	25.3	48.3
Mean	12.0	13.1	22.9	36.4	48.2	58.2	63.8	61.9	53.6	44.9	30.6	18.4	38.8
Mean Minimum	4.0	3.5	13.6	25.8	37.0	46.5	52.7	50.9	43.6	36.2	24.3	11.5	29.2
Extreme Minimum	-27	-25	-22	-3	19	25	32	30	21	10	2	-17	-27
PRECIPITATION (Inches)													
Extreme Max (Water Eq)	5.13	3.45	3.43	5.12	6.87	9.34	9.00	5.86	5.19	6.09	6.16	5.75	40.18
Mean (Water Equivalent)	1.96	1.95	2.02	2.60	3.26	3.34	3.13	3.14	3.75	2.88	2.68	2.70	32.96
Extreme Min (Water Eq)	0.81	0.80	0.62	0.65	1.29	0.71	1.05	0.34	1.31	0.91	1.14	0.72	27.98
Extreme Max Snowfall	92.8	40.1	37.3	17.4	4.9	T	T	0	3.8	10.8	41.5	70.9	221.4
Mean Snowfall	24.9	24.3	19.5	6.4	1.5	T	0	0	0.2	3.0	18.0	30.4	131.2
Extreme Min Snowfall	8.6	6.8	0.2	0.4	0	0	0	0	0	0	7.0	8.3	89.4
Mean Snow Depth	17.3	23.6	18.0	5.1	T	0	0	0	T	T	5.4	13.1	13.8 Nov-Apr
SKY COVER													
0-4/10 (% of time)	22.2	27.8	32.1	31.9	33.1	37.2	41.6	43.6	35.2	29.2	16.5	18.9	30.8
5-8/10 (% of time)	13.8	14.4	15.4	15.6	18.5	19.6	24.4	21.3	18.3	15.4	13.0	11.6	16.8
9-10/10 (% of time)	64.0	57.8	52.5	52.5	48.4	43.2	34.0	35.1	46.5	55.4	70.5	69.5	52.4
Mean Sky Cover-Tenths	7.6	7.1	6.7	6.7	6.5	6.1	5.6	5.5	6.3	6.9	8.2	8.0	6.8
CEILING/VISIBILITY (%)													
Less than 200/½	2.4	2.9	3.4	4.0	2.2	3.5	1.7	2.4	3.9	4.0	4.9	3.5	3.2
200/½-1500/3	25.0	24.3	18.2	17.6	13.0	11.9	7.8	11.0	17.1	19.1	25.7	30.8	18.2
Above 1500/3	72.6	72.8	78.4	78.4	84.8	84.6	90.5	86.6	79.0	76.9	69.4	65.7	78.6
WEATHER (Days Per Month)													
Thunderstorms and/or Hail	0.1	0	0.5	1.4	3.3	6.2	6.2	5.3	3.5	1.6	0.7	0.1	28.8
Rain and/or Drizzle	1.2	0.8	3.9	8.3	15.3	16.1	13.3	14.4	16.3	14.9	9.9	2.5	116.9
Freezing Rain or Drizzle	3.5	2.4	2.9	1.9	0.2	0	0	0	0	0	1.6	3.8	16.3
Snow and/or Sleet	21.6	18.3	15.3	8.5	3.2	0.2	0.1	0	0.9	5.7	15.9	23.5	113.2
Fog	8.3	7.1	9.5	10.5	10.3	13.3	12.1	15.3	17.1	14.7	13.2	10.3	141.7
No Precip or Fog	5.3	6.1	8.8	11.5	10.8	9.3	10.6	9.8	7.4	7.4	5.1	3.9	96.0

DATA BASE 1 OCTOBER 1956 THROUGH 31 OCTOBER 1974

AIR WEATHER SERVICE/MAC

SURFACE WINDS

PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED (FROM HOURLY OBSERVATIONS)

STATION: [illegible] STATION NAME: GWINN MICHIGAN/K I SAWYER AFB YEARS: 56-70 MONTH: ALL

CLASS: ALL WEATHER HOURS (L.S.T.): ALL

CONDITION:

SPEED (KNTS) DIR.	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	22 - 27	28 - 33	34 - 40	41 - 47	48 - 55	≥56	%	MEAN WIND SPEED
N	1.2	2.0	3.2	3.6	1.3	.4	.1	.0				11.4	[illegible]
NNE	.5	1.7	2.9	1.7	.2	[illegible]	.0					7.2	[illegible]
NE	.4	1.4	1.7	.6	.0	.0						4.3	7.4
ENE	.4	.8	.5	.1	.0	.0						1.[illegible]	[illegible]
E	.5	.8	.4	.1	.0	.0						1.[illegible]	[illegible]
ESE	.3	.4	.3	.1	.0	.0						1.1	[illegible]
SE	.2	.6	.5	.2	.0	.0						1.5	[illegible]
SSE	.4	.9	1.2	.7	.1	.0						3.2	[illegible]
S	1.1	3.0	4.4	3.4	.6	.1	.0					12.6	[illegible]
SSW	1.1	2.6	3.2	2.2	.4	.1	.0	.0				9.3	[illegible]
SW	.8	1.8	1.9	1.1	.2	.0	.0					5.[illegible]	7.[illegible]
WSW	.0	1.4	1.4	.7	.1	.0	.0					4.2	7.4
W	1.4	2.4	2.3	1.1	.1	.0	.0					7.4	[illegible]
WNW	.9	1.7	1.8	1.1	.1	.0						5.6	7.7
NW	.6	1.3	2.1	1.3	.2	.0	.0					5.7	[illegible]
NNW	.6	1.0	1.8	1.[illegible]	.3	.1	.0					5.6	[illegible]
VARBL													
CALM	X	X	X	X	X	X	X	X	X	X	X	11.4	
	11.1	23.6	22.7	13.[illegible]	[illegible]	.	.1	.0				100.0	7.4

TOTAL NUMBER OF OBSERVATIONS 109169

BEST AVAILABLE COPY

USAFETAC FORM 0-8-5 (OL-1) PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

DATA PROCESSING DIVISION
NATIONAL WEATHER SERVICE/NOAA

EXTREME VALUES

SURFACE WINDS
(FROM DAILY OBSERVATIONS)

STATION [illegible] STATION NAME GWINN MICHIGAN/K I SAWYER AFB YEARS 62-70

DAILY PEAK GUSTS IN KNOTS

YEAR \ MONTH	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ALL MONTHS
62	[illegible]	[illegible]	33/	26/	37/	34/	30/	33/	SSW 43/	32/	SSW 31/	38	SSW 43
63	NW 36/	[illegible]	[illegible]	[illegible]	[illegible]	25/	[illegible]	[illegible]	[illegible]	SSW 39/	[illegible]	39	NNW 45
64	[illegible]	[illegible]	34/	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	41/	[illegible]	37	SSW [illegible]
65	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37/	[illegible]	[illegible]	[illegible]
66	S 36/	31/	[illegible]	[illegible]	[illegible]	31/	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
67	NW 37/	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
68	S 37/	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
69	36/ 37	36/ 35	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
70	36/ 36	36/ 40	36/ [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
71	33/ 40	18/ 40	01/ 41	35/ 40	25/ 31	20/ 32	21/ 37	25/ 40	22/ [illegible]	20/ [illegible]	02/ [illegible]	23/50	
72	[illegible]	[illegible]	30/ 43	01/ 21	36/ 40	01/ 32	23/ 39	21/ 23	23/ [illegible]	21/ [illegible]	02/ [illegible]	01/49	
73	34/ 34	18/ 37	15/ 42	03/ 41	35/ 40	22/ 31	30/ 32	20/ 38	23/ 31	21/ [illegible]	32/ [illegible]	37/45	
74	32/35	30/35	13/ 33	35/36	13/32	33/35	21/34	22/30	21/ [illegible]	[illegible]	[illegible]	[illegible]	15/42
75	18/50	33/30	03/36	35/ [illegible]	27/40	22/40	36/32	21/37	32/30	25/23			[illegible]
MEAN	[illegible]	37.1	[illegible]	40.1	37.7	35.[illegible]	[illegible]	34.0	33.3	[illegible]	30.3	39.4	47.3
S.D.	1.9[illegible]	3.8[illegible]	5.[illegible]	3.15[illegible]	5.[illegible]	[illegible]	4.[illegible]	[illegible]	6.1[illegible]	[illegible]	6.713	2.503	7.[illegible]
TOTAL OBS.	247	254	278	25[illegible]	279	2[illegible]	[illegible]	277	[illegible]	247	239	249	3054

[illegible]450

Deg. Days

	[illegible]	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Jan	1731	1824	1524	1530	1369	1763	1849	1798	1534	1638	1543
Feb	1577	1419	1590	1436	1360	1538	1520	1611	1407	1552	1332
Mar	1455	1175	1255	944	1396	1357	1437	1450	1030	1342	1356
Apr	9[illegible]	[illegible]	[illegible]	516	511	868	[illegible]	1038	891	864	1616
May	[illegible]	5[illegible]2	[illegible]	[illegible]	521	611	[illegible]	385	691	599	375
June	206	145	[illegible]	139	376	208	155	[illegible]	[illegible]	[illegible]	152
July	102	21	[illegible]	43	82	95	151	150	116	73	81
Aug	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	139	[illegible]	[illegible]	[illegible]	136	[illegible]
Sept	[illegible]	31	[illegible]	131	[illegible]	[illegible]	248	[illegible]	[illegible]	[illegible]	401
Oct	[illegible]	718	[illegible]	[illegible]	[illegible]	599	453	811	[illegible]	716	649
Nov	[illegible]	[illegible]	994	[illegible]	[illegible]	1018	[illegible]	[illegible]	[illegible]	1080	
Dec	1277	1435	1277	1211	1367	1434	1376	1594	1442	1293	
Total/Yr	10056	9565	9446	7646	9428	9940	10026	10914	9312		

FY66	FY67	FY68	FY69	FY70	FY71	FY72	FY73	FY74	FY75
9916	9770	8456	8912	9887	10132	10132	10050	7845	9550

	FY66	FY67	FY68	FY69	FY70	FY71	FY72	FY73	FY74	FY75
Purchases (Gals) [illegible] Fuel Oil			2,155,[illegible]	1,920,5[illegible]	2,[illegible]	1,976,[illegible]	[illegible]	[illegible]	1,469,[illegible]	1,616,009